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NASA WILL LAUNCH
THIRD INTERPLANETARY
MONITORING PLATFORM

The third in the Interplanetary Monitoring Platform (IMP) series of Explorer satellites is scheduled for launch by the National Aeronautics and Space Administration no earlier than May 28 from Cape Kennedy.

The IMP series, designed to measure magnetic fields, cosmic rays and the solar wind, got off to a successful start with Explorer XVIII, launched Nov. 26, 1963. The satellite gave physicists a new view of how the Earth's magnetic field extends into space and becomes distorted by the Sun's powerful influence.

That and other discoveries attributed to Explorer XVIII have made the near-Earth region of space an area of prime scientific interest and one of rapidly expanding knowledge.

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5/18/65

The new satellite, IMP-C, will be launched by a three-stage Delta. The highly elliptical orbit is planned to be inclined 33 degrees to the Equator and to take the satellite 130,000 miles into interplanetary space and as close to Earth as 120 miles. About four days will be required for the 130-pound satellite to complete an orbit.

The spacecraft contains nine experiments by scientists from the universities of California, Berkeley, and Chicago, Massachusetts Institute of Technology, Cambridge, NASA's Goddard Space Flight Center, Greenbelt, Md., and the NASA Ames Research Center, Mountain View, Calif.

The IMP series is part of the space exploration program of NASA's Office of Space Science and Applications. Project management is exercised by the Goddard center which designs, builds and tests the IMP satellites.

Aside from gathering data on geomagnetic and interplanetary magnetic fields, an important objective of the IMP series is to study charged particles coming from the Sun and from sources beyond the solar system. Similar measurements are being extended millions of miles deeper into space by the Mariner IV enroute to a July 14 fly-by of Mars.

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The IMP studies complement the scientific objectives of the NASA Orbiting Geophysical Observatories and will contribute to the development of solar flare prediction capability which will be useful to the NASA Apollo manned Moon landing program.

(BACKGROUND INFORMATION FOLLOWS)

- more -

THE IMP SATELLITE

The IMP-C is a compact 130-pound physics laboratory. It has an octagon base, eight inches high and about 28 inches in diameter. All but two of its experiments are mounted in this eight-sided base.

Magnetometers, which measure magnetic fields in space, have been mounted to avoid interference from the weak magnetic field created by the satellite itself. A rubidium-vapor magnetometer is mounted on a boom which will telescope out six feet after orbit is attained. Two fluxgate magnetometer sensors--folded at time of launch--will be extended on seven-foot booms.

The satellite will be spin-stabilized in orbit.

Solar cell arrays are mounted on four panels. The power derived from the Sun will charge 13 silver-cadmium batteries. The satellite's four-watt transmitter, weighing one and one-half pounds, will transmit data to NASA's worldwide network of tracking and receiving stations.

LAUNCH WINDOW

The period during which the launch can be made (launch window) is calculated to take full advantage of the gravitational influences of the Earth, Moon and Sun on the spacecraft. The window is limited to about a one-hour period on certain days of the month.

SCIENTIFIC OBJECTIVES

As were the earlier IMP satellites, the primary objectives of IMP-C are to measure magnetic fields, cosmic rays and solar winds in interplanetary space--the region beyond the influence of the Earth's magnetic field.

Magnetic Fields

The basic device for measuring magnetic fields is the magnetometer. The satellite carries two types of magnetometers provided by the Goddard Space Flight Center. They are:

1. The rubidium-vapor magnetometer, a five-pound ball-shaped device, 13 inches in diameter, mounted six feet above the satellites's main structure.
2. Two fluxgate magnetometers, mounted on seven-foot booms attached to the base of the satellite.

The experiments accurately measure magnitude and direction of the magnetic field in space. The information obtained is of value in determining the physical state of the interplanetary space, its dynamical characteristics and the interactions of the streaming solar plasma with the geomagnetic field.

Primary objective of these experiments is to measure the interplanetary magnetic field undisturbed by the presence of the Earth's field. In addition, the instruments also can be used for measurement of fields in the vicinity of the Earth's geomagnetic cavity boundary and the interaction region associated with the solar streaming plasma and the geomagnetic field.

The rubidium vapor magnetometer measuring the magnitude of magnetic fields is used with a bias coil system which permits directional measurement.

The two fluxgate magnetometers are to measure the direction of weak magnetic fields. The instrumentation is complementary in that the rubidium vapor magnetometer permits the calibration of the zero levels of the fluxgate magnetometers in flight.

The dynamic range of the fluxgate sensors is ± 40 gamma (1 gamma = 10^{-5} gauss) with an accuracy of $\pm .16$ gammas. The dynamic range of the rubidium vapor magnetometer is 0.1 gammas to 1000 gammas. The magnetic field strength near the Earth varies from 30,000 gammas at the equator to about 70,000 gammas at the poles.

Cosmic Rays

Both types of cosmic radiation--galactic and solar--will be studied. Four experiments will measure cosmic ray intensity, composition and direction. They are:

1. A device which used solid-state detectors and a range-energy loss telescope to search out charged particles of comparative low energy. This will study the particle spectrum and its nuclear composition, concentrating on hydrogen, helium and lithium. Since it is now a period of comparative solar quiet, this is an opportune time to detect these low energy particles which are believed to be of galactic origin. The device also will monitor

in detail the particle energies resulting from solar flares which may occur during the satellite's lifetime. It will also look for low energy trapped protons in the Earth's magnetosphere. (Prepared by the University of Chicago.)

2. Two pancake-shaped geiger counters--called particle telescopes--are to obtain data on direction and flux of cosmic rays produced by large solar flares. With this data, it is hoped an integrated idea of interplanetary magnetic fields eventually will be obtained. (Prepared by the Goddard Space Flight Center.)

3. A particle telescope to measure the flux of galactic cosmic rays and identify hydrogen, deuterium, tritium, and helium in energy ranges of from 12 to 80 million electron volts. The flux of electrons of energy from one to 20 million electron volts also will be studied. This experiment will provide data on energetic electrons in space beyond the Van Allen belt. Time variations in observed fluxes of these electrons provides evidence about their origin. (Prepared by the Goddard Space Flight Center.)

4. An ion chamber to measure the presence of proton radiation and determine its quantity in terms of a dose rate of roentgens per hour. Changes in intensity of cosmic radiation caused by flare activity also will be recorded. (Prepared by the University of California.)

Another experiment being flown consists of two geiger counter tubes to detect fluxes of electrons with an energy above 40,000 electron volts. Electrons of this energy play an important role in many geophysical phenomena. Information on this flux helps determine the Sun's role in supplying energy to the Earth's radiation belts. (Prepared by the University of California.)

Solar Winds

Three experiments on board the satellite will study the effects of solar wind in interplanetary space.

1. A curved-plate electrostatic analyzer will separate solar particles in terms of their energy. The separated particles produce a current--which is a function of the energy level--and can be measured by an electrometer circuit. The device is calibrated to determine solar wind particle flux in the vicinity of the satellite. To do its job, proton concentrations will be determined

by admitting them through a slit of known dimensions in the side of the satellite. (Prepared by the NASA Ames Research Center.)

2. Another way to measure the solar wind is with a device which will permit particles to enter a six-inch-diameter surface through a series of grids that separate electrons and low-energy positive particles. This instrument will determine flux, speed and direction of the particles analyzed. (Prepared by the Massachusetts Institute of Technology.)

3. A small sensor called the thermal ion electron experiment will collect particles and measure the amount of electrical charge they carry. Positive and negative ions and electrons are to be measured. This data may indicate whether low energy particles constitute a stationary gas or one that moves as part of the solar wind. (Prepared by the Goddard Space Flight Center.)

SCIENTIFIC FINDINGS OF EXPLORER XVIII

The experiments carried into space by the first IMP, Explorer XVIII, have given the scientific community valuable new information.

Of special significance have been the studies of the boundary or transition region between the Earth's magnetosphere and interplanetary space.

The magnetosphere is the envelope formed by the Earth's magnetic field which protects man from the radiation levels existing in interplanetary space after a major solar flare. Explorer XVIII pioneered in the mapping of this region on the Sun side of the Earth.

Among Explorer XVIII's important contributions thus far has been the discovery of a shock wave preceding the Earth's magnetosphere. This wave, similar to that created by a supersonic aircraft, is caused by the solar wind. Between the shock wave and the magnetosphere boundary a turbulent region of highly energetic plasma also has been discovered.

Mapping of these regions by Explorer XVIII's magnetometers shows that the shock wave and the turbulent transition region trails back and away from the Earth in increasingly widening bands, much in the manner of the wake of a ship at sea. This "wake" of particles in lessening intensity, may extend as far back as a quarter of a million miles, or more.

Another important Explorer XVIII discovery was made Dec. 14 and 15, 1963, when the satellite was near apogee during its fifth orbit. Its magnetometers registered significant increases in magnetic field strengths which had not previously been noted in interplanetary space. Evaluation of the data coupled with the position of the satellite in space has attributed the increased magnetic field to the fact that the spacecraft was passing through the tail portion of a lunar magnetosphere.

While these discoveries have been the most significant new findings of the first IMP, studies of the strength, velocity and changes in solar wind plus new insights into the intensity and time variations of cosmic rays also have been of more than routine scientific interest. The orbiting of IMP-C, it is hoped, will provide still more valuable information in these areas.

More than 5,600 hours of scientific data were provided by Explorer XVIII before its transmission became intermittent in May 1964. A few hundred more hours of data were received before monitoring of the satellite ceased a year later.

The second IMP, Explorer XXI, was launched Oct. 4, 1964. It was short of its planned orbit, but has provided added data on the magnetosphere.

The IMP Team

The National Aeronautics and Space Administration's Office of Space Science and Applications is responsible for the Interplanetary Explorer Satellite. The IMP-C satellite--as were the first two IMPs--was designed, built and tested at the Goddard Space Flight Center, Greenbelt, Md.

Prime contractor for the Delta launch vehicle is Douglas Aircraft Co., Santa Monica, Calif. Douglas also is responsible for pre-launch and launch operations under the supervision of the Goddard Launch Operations at Cape Kennedy,

Contractor for integration was EMR, College Park, Md.

Key officials responsible for the Interplanetary Explorer program and its experiments are:

NASA HEADQUARTERS

Dr. Homer E. Newell, Associate Administrator for Space Science and Applications

Dr. John E. Naugle, Director, Geophysics and Astronomy Programs Division

Dr. Alois W. Schardt, Program Scientist

Frank Gaetano, Program Manager

T. Bland Norris, Delta Program Manager

GODDARD SPACE FLIGHT CENTER

Dr. Harry J. Goett, Director

Paul Butler, Project Manager

Frank A. Carr, Assistant Project Manager

Dr. Frank B. McDonald, Project Scientist

William R. Schindler, Delta Project Manager

Robert H. Gray, Director, Goddard Launch Operations, Cape Kennedy

The Experimenters

Magnetic Field Experiment - Rubidium vapor magnetometers
Dr. Norman F. Ness, Goddard Space Flight Center

Magnetic Field Experiment - Fluxgate magnetometer
Dr. Norman F. Ness, Goddard Space Flight Center

Cosmic Ray Experiment	- Range versus energy loss Dr. J. A. Simpson, Enrico Fermi Institute, University of Chicago
Cosmic Ray Experiment	- Energy versus energy loss Dr. Frank B. McDonald and Dr. George Ludwig, Goddard Space Flight Center
Cosmic Ray Experiment	- Orthogonal Geiger Counter Telescope Dr. Frank B. McDonald and Dr. George Ludwig, Goddard Space Flight Center
Cosmic Ray Experiment	- Ion chamber and geiger counter tubes Dr. Kinsey A. Anderson University of California
Solar Wind Experiment	- Low energy proton analyzer Dr. John Wolfe, Ames Research Center
Solar Wind Experiment	- Plasma probe Dr. Herbert S. Bridge, Massa- chusetts Institute of Technology
Solar Wind Experiment	- Thermal ion electron sensor Robert Bourdeau and Gideon P. Serbu, Goddard Space Flight Center

FACT SHEET

(IMP-C)

Launch: On or about May 28, 1965
Eastern Test Range, Cape Kennedy, on
Delta rocket

Apogee: 130,000 statute miles

Perigee: 120 statute miles

Inclination: 33 degrees

Period: About four days

Velocity: 24,300 mph at perigee
780 mph at apogee

Weight: 130 pounds

Main Structure: Octagon, 28 inches by 28 inches; eight
inches high

Appendages: Four solar paddles, 27.6 inches long by
20 1/8 inches wide

Four antennas, 16 inches long

Rubidium-vapor magnetometer, on six-foot
boom

Two fluxgate magnetometers on seven-foot
booms

Power System

Power supply: 6,144 N/P mounted on four solar-oriented
arrays; one five-ampere-hour battery pack
of 13 silver cadmium cells

Voltage: 11.5 to 19.6 vdc

Power: 38 watts

Communications and data-handling system

Telemetry: Pulsed-frequency modulation (PFM)

Transmitter: Four-watt output at 136.125 mcs

Encoder: PFM with digital data processor (DDP)
for accumulation and storage of data

Tracking: Stations of the world-wide Space
Tracking and Data Acquisition Network
(STADAN) operated by the Goddard Space
Flight Center

Data-Acquisition
Station:

Johannesburg, South Africa
Woomera, Australia
Santiago, Chile
(Some data received from other network
stations in sight at perigee)

Range and Range
Rate Stations:

Rosman, N.C.
Carnarvon, Australia

The Delta Launch Vehicle

The NASA-developed, three-stage Delta vehicle will be used to launch IMP-C into orbit. Delta project management is under the direction of the Goddard Space Flight Center.

The Delta vehicle has the following general characteristics:

Height: 90 feet
Maximum Diameter: 8 feet
Lift-off Weight: About 57 tons

First Stage: Thor space booster, produced by Douglas Aircraft Co.

Propellants: Liquid (Kerosene with liquid oxygen as oxidizer)

Thrust: 170,000 pounds

Burning Time: About two minutes and 25 seconds

Weight: Over 50 tons

Second Stage: Aerojet General Corp., JA 10-118 propulsion system

Propellants: Liquid (UDMH and IRFNA)

Thrust: About 7,500 pounds

Burning Time: About two minutes and 54 seconds

Weight: Approximately 6,500 lbs.

Third Stage: Alleghany Ballistics Laboratory X-258 motor

Propellants: Solid

Thrust: About 5,700 pounds

Burning Time: 24 seconds

Weight: About 576 pounds

Length: 59 inches

Diameter: 18 inches

During first and second stage powered flight, the Bell Telephone Laboratory radio-guidance system is used for in-flight trajectory corrections. It also commands second-stage cutoff when the desired position, velocity and altitude have been achieved.

Following second stage cutoff, a 32-second coast period occurs. During this period, small rockets mounted on a table between the second and third stages ignite and spin up the third stage and the satellite to the desired spin rate. The second and third stages then separate and third stage ignition occurs, giving IMP its final boost toward orbital injection. Once in orbit, IMP's spin rate will be approximately 20 rpm.

The chief Douglas Delta system engineer is J. Kline and Gen. Marcus Cooper is head of the Douglas Field Office at Cape Kennedy.

END

MOON'S WAKE ENCOUNTERED BY IMP

